

Abstract

A face and environment sensing portable device. In a preferred embodiment, the device is wrist-worn by a person, similarly to a wristwatch. The portable device includes one or more sensing elements, such as an image-capturing device, a  
5 microphone or other environmental sensor, and a processing system for processing data obtained from the sensing element(s). In addition, the portable device may include input/output elements for interfacing the portable device with a person and with external systems. The portable device reliably authenticates the identity of the person based on information obtained from the sensing element(s) and may also  
10 determine whether the user has been in continuous possession of the device. By using multi-modal identification, the invention may provide increased confidence, while maintaining a low cost. This verification may then be used, for example, to enable the person to conduct secure transactions. The verification may also be used to tailor or customize applications and services to the user's personal preferences. The invention  
15 avoids drawbacks of conventional authentication techniques, such as inaccuracies in manual photographic identification techniques and the proliferation of excessive numbers of passwords. In another aspect, the invention overcomes drawbacks in the abilities of low-cost image sensors by applying superresolution techniques to combine multiple lower quality images into an image with improved quality. Super-resolution  
20 processing can be performed in the portable device itself or by an external infrastructure.